

NASA TECH BRIEF

Marshall Space Flight Center



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Materials Data Handbooks on Stainless Steels

Steel, the most widely utilized metal in the world today, is produced in many grades. One large group includes stainless steels developed since 1913. There are many varieties of stainless steel; each basically contains a certain percentage of chromium or chromium-nickel alloy, to impart corrosion resistance and provide good strength and resistance to scaling at elevated temperatures.

Two handbooks which summarize the latest available data have been published, which describe two types of stainless steel. One is alloy A-286; the other is Type 301.

Alloy A-286 is a precipitation-hardened, heat-treatable, austenitic stainless steel developed as an improvement on Tinidur. As a superalloy or heat-resistance alloy, A-286 has been designed for service at temperatures as high as 1300° F (704° C) for applications requiring high strength and good resistance to corrosion at operating temperatures, and for service at higher temperatures where applications are at lower stresses.

Hot-working characteristics resemble those of other stainless steels rather than those of other superalloys. Machinability of A-286 is similar to that of other austenitic steels, including "gumming," in the soft solution-treated condition. The alloy is welded readily by shielded-arc and inert-gas-arc techniques; however, it is recommended that the material be in an essentially stress-free solution-treated condition prior to welding.

Typical areas of application of A-286 include structures for jet engines and superchargers, turbine wheels and blades, frames, castings, and afterburner parts. The alloy is particularly attractive for applications as fasteners and springs for elevated-temperature service because of relatively low-stress-relaxation or loss of load in operations.

Type 301, on the other hand, is the lowest alloyed member of the 18-percent chromium, 8-percent nickel series of steels, belonging to the larger family of austenitic stainless steels. The austenitic Fe-Cr-Ni alloys lead to the 18-8 series of stainless steels, which are widely used today. These were developed as corrosion-resistant alloys for use in pyrometer tubes; however, they also possess excellent resistance to oxidation, as well as good creep strength at elevated temperatures, and good cold formability.

Of the austenitic stainless steels, Type 301 is the one used most frequently at high-strength levels in aircraft and missiles because of its greater work-hardening characteristics. Also, because of its high-strength properties, Type 301 is used in the construction of bus, truck, trailer, and railroad-car bodies. It is used for automobile wheel discs, architectural trim, flashing, and roof-drainage products.

Each handbook is divided into twelve chapters. The scope of the information presented includes physical- and mechanical-property data at cryogenic, ambient, and elevated temperatures, supplemented with useful information in such areas as material procurement, metallurgy of the alloy, corrosion, environmental effects, fabrication, and joining techniques. Design data are presented, as available, and these data are complemented with information on the typical behavior of the alloy.

Throughout the texts, tables, and figures, common engineering units (with which measurements were made) are accompanied by conversions to International (SI) Units, except in the instances where double units would overcomplicate data presentation or where SI units are impractical (e.g., machine tools and machining). In these instances, conversion factors are noted.

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Note:

Requests for specific handbooks may be directed to:
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